



GAIL FARBER, Director

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

"To Enrich Lives Through Effective and Caring Service"

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P.O. BOX 1460
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August 5, 2009

IN REPLY PLEASE

REFER TO FILE:

WW-1

TO: Each Supervisor

FROM: Gail Farber *Gail Farber*
Director of Public Works

BOARD MOTION OF NOVEMBER 5, 2008, AGENDA ITEM 70-A IMPLEMENTATION ACTION PLAN FOR THE USE OF GRANULAR-ACTIVATED CARBON AND CHLORINE

Background

On November 5, 2008, your Board directed the Department of Public Works to conduct a public outreach effort throughout the Antelope Valley to present information on available disinfection options to meet a new Federal drinking water standard for trihalomethanes (THMs) and report back to your Board within 120 days.

On March 11, 2009, we reported back to your Board with the results of our public outreach effort and made a recommendation, based on community input, that we initiate discussions with the Districts' wholesale water agency, the Antelope Valley-East Kern Water Agency (AVEK), on the use of granular-activated carbon (GAC) and chlorine to comply with the new THM standard. Your Board approved the recommendation and directed Public Works to report back to your Board with an implementation action plan within 120 days (see attached).

We initiated discussions with AVEK and, on April 15, 2009, AVEK's General Manager requested his consultant, MWH Consulting Engineers, to prepare a report analyzing impacts of implementation of GAC treatment at AVEK's treatment plants (copy attached).

Following is a summary of AVEK's report of impacts, the financial impacts of GAC treatment implementation on your Board's customers, and recommended implementation steps for your consideration.

Summary of AVEK Report Regarding Impacts of GAC Implementation

AVEK reports that implementation of GAC treatment and chlorine disinfection can be effectively incorporated into the existing AVEK treatment plants and will produce water meeting Federal drinking water standards for THM. The implementation of the treatment would require major capital improvements to AVEK's existing facilities. The estimated capital improvement cost of GAC treatment facilities is approximately \$70 million, and the estimated annual operation and maintenance cost is \$18 million. The timeline for completion of the improvements is estimated to be 36 to 42 months.

AVEK estimates the wholesale water rates it charges retail agencies will increase from \$325 per acre foot to \$595 per acre foot due to the capital improvement costs and ongoing maintenance and operation associated with GAC treatment.

Financial Impact to Waterworks Districts 37 (Acton) and 40 (Antelope Valley) Customers

The increase in AVEK wholesale water rates due to the implementation of GAC treatment would result in a recommendation that your Board consider a rate increase for both Districts 37 and 40. The estimated bimonthly rate increase is \$53 (46 percent) in Waterworks District 37 and \$38 (51 percent) in Waterworks District 40. This would result in an increase in current average bimonthly water bill from \$116 to \$169 in District 37 and from \$75 to \$113 in District 40.

Implementation Action Steps

1. Conduct a customer outreach effort, including public meetings, informational fliers and a survey to inform customers of the results of the AVEK report regarding the implementation of GAC treatment, the associated potential rate increases to customers of Waterworks Districts 37 and 40 and to verify the customers preferred method of treatment.
2. Report back to your Board and recommend a preferred treatment method for THM based on the results of customer outreach.

Each Supervisor
August 5, 2009
Page 3

3. Report your customers' preference, along with the other retail water agencies to AVEK for their use in determining which treatment method for THM they will implement.

AA:kk

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Attach.

cc: Chief Executive Office (Lari Sheehan)
County Counsel
Executive Office



GAIL FARBER, Director

COUNTY OF LOS ANGELES

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IN REPLY PLEASE

REFER TO FILE: **WW-0**
A2952

March 11, 2009

TO: Each Supervisor *Gail Farber*
FROM: Gail Farber
Director of Public Works

BOARD MOTION OF NOVEMBER 5, 2008, AGENDA ITEM 70-A PUBLIC OUTREACH EFFORT ON WATER DISINFECTION OPTIONS

Recommendations

1. Initiate discussions with the Antelope Valley-East Kern Water Agency on the use of granular activated carbon (GAC) and chlorine for its treatment plants instead of chloramines to comply with the new regulatory standards for trihalomethanes (THMs).
2. Report back to your Board with an implementation action plan within 120 days.

Background

On November 5, 2008, your Board directed Public Works to conduct a public outreach effort (including hosting community meetings throughout the Antelope Valley, providing information about chloramines to the media, and enclosing information about chloramines in water bills to the Waterworks Districts' customers) and report back to your Board within 120 days.

The following is a report describing the public outreach effort and summarizing the feedback received from the community meetings.

Public Outreach Effort

Community meetings were conducted in Acton, Lancaster, Palmdale, and Lake Los Angeles in late January. Presentations by the Los Angeles County Waterworks Districts' staff covered the following topics:

- Regulatory Requirements - The regulatory requirement to disinfect drinking water to protect the public's health and safety from potential microbial contamination.
- Health Effects - The health effects of THMs, known carcinogens, and by-products of the disinfection of drinking water with chlorine.
- Disinfection Options – The two applicable disinfection options identified by a study conducted for the Antelope Valley-East Kern Water Agency by a private engineering consultant in 2005 that were discussed are:
 1. Chloramines - Use of chloramines (a combination of chlorine and ammonia), instead of the currently used chlorine for disinfection.
 2. Granular Activated Carbon - Use of GAC filters to remove organic materials that produce THMs when chlorine is used to disinfect the water.
- Advantages and Disadvantages - The advantages and disadvantages of available disinfection options to comply with newly enacted, more stringent water quality standards for THMs (see attached).

In addition to the community meetings, the following public education actions were completed:

- Included educational materials in the Districts' Fall Splash newsletter sent to all customers with their bills.
- Presented to the Palmdale Chamber of Commerce on November 19, 2009, that included an interview with the local television station.
- Provided information to the Antelope Valley Press for an article published on January 23, 2009.
- Conducted a telephone interview with Jim Crockett for the Agua Dulce/Rosamond/Lake Los Angeles News.

- Responded to numerous correspondences and emails and provided the individuals with information related to chloramines.

Meeting Attendees - There were 206 community members who signed the attendance sheet. The majority of the attendees favored the use of GAC and chlorine disinfection.

Following are the most frequently raised concerns regarding the use of chloramines for drinking water disinfection.

- Skin rashes and respiratory problems that are purportedly attributed to the use of water disinfected with chloramines.
- Effects on fish and amphibians. The ammonia in chloraminated water is harmful to fish and amphibians if not removed.
- Leaching of lead and copper from household plumbing. Water that is disinfected with chloramines could result in more leaching of lead and copper from household plumbing than with chlorine.
- Contamination of groundwater with nitrate. The ammonia from chloraminated water, used to irrigate landscaping, could contaminate the groundwater basin.
- Formation of yet-to-be-regulated disinfection by-products. The potential for harmful disinfection by-products from the use of chloramines.
- Removal of chloramines from water. The cost to remove chloramines using home treatment systems.

These concerns are not unique to the residents of Acton and the Antelope Valley and have been extensively investigated and addressed by the Federal Environmental Protection Agency, the State Department of Public Health, and other reputable organizations.

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Conclusion

The current chlorine disinfection of the water in Los Angeles County Waterworks District Nos. 40, Antelope Valley, and 37, Acton, has to be changed to meet new, more stringent water quality requirements. There are two disinfection options being considered, each has its own technical advantages and disadvantages. Both options will result in an increase in the cost of water to the Districts' 55,000 customers and will be subject to Proposition 218 notification requirements.

We held community meetings in Acton, Lancaster, Palmdale, and Lake Los Angeles to solicit feedback on the two options. The majority of the meeting attendees favored the use of GAC and chlorine disinfection.

Before implementation of GAC, we need to work with the Antelope Valley-East Kern Water Agency to resolve any technical issues to ensure the safety of the treated water. GAC does not remove bromide salt, prevalent in State Water Project water during dry periods, and it has not been used in a large scale filtration plant for the control of THMs. Recently, the Palmdale Water District started using GAC and is still making adjustments to its system to ensure safety standards are met. We also want to carefully monitor GAC filtration costs since the cost of the materials has increased almost 133 percent in the last five years.

DWP:dvt

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Attach.

cc: Chief Executive Office (Lari Sheehan)
County Counsel
Executive Office

ADVANTAGES AND DISADVANTAGES OF DISINFECTION OPTIONS

March 11, 2009

1. **Chloramines** – Use of chloramines, a combination of chlorine and ammonia, instead of the currently used chlorine for disinfection. Chloramines do not produce THMs when they are used to disinfect water.

Advantages	Disadvantages
Low levels of THMs are formed.	There is a potential for the growth of bacteria through a process called "nitrification" if the distribution system is not adequately maintained.
Chloramines are likely to form less THMs in the distribution system and last longer, which helps prevent the growth of bacteria.	Chloramines can be harmful to fish and amphibians if a water conditioner is not used.
Most people report better taste and odor for chloraminated water as compared to chlorinated water.	Kidney dialysis equipment must be modified to remove chloramines.
Use of chloramines will modestly increase customers' water bills by 5% to 16%, depending on water usage.	Use of chloramines could cause more lead and copper leaching in household plumbing than chlorine if corrosion control practices are not followed.

Communities in California using Chloramines: Agoura Hills, Anaheim, Antioch, Beverly Hills, Brentwood, Burbank, Burlingame, Calabasas, Corona, El Segundo, Glendale, Goleta, Hidden Hills, Irvine, Lake Elsinore, Livermore, Long Beach, Malibu, Manhattan Beach, Martinez, Murietta, Newport Beach, Norco, Oakland, Orange, Palo Alto, Pasadena, Pittsburgh, Pleasanton, Redwood City, Riverside, San Bruno, San Diego, San Francisco, Santa Ana, Santa Barbara, Santa Clara, Santa Clarita, Santa Maria, Santa Monica, Temecula, Topanga, Tustin, Val Verde, Ventura, and Westlake Village.

2. **Granular Activated Carbon** – Use of GAC filters removes organic materials that produce THMs when chlorine is used to disinfect the water.

Advantages	Disadvantages
It removes organic materials and, as a result, produces low levels of THMs and, overall, potentially better water quality.	Use of GAC will increase customers' water bills by 28% to 96%, depending on water use.
Most people report better taste and odor due to removal of organic materials from the water.	GAC does not remove bromide salt (prevalent in State Water Project water particularly during dry periods), which forms THMs when chlorine is used for disinfection. Additionally, because GAC does not remove all of the organic materials from water, THMs will continue to be formed in the distribution system.
	The need for frequent GAC replacement could impact treatment plant operations and production capacity.

Agencies in California using GAC: There are presently two agencies in California using GAC, and they are Crestline-Lake Arrowhead Water Agency and Palmdale Water Agency.



MINUTES OF THE BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES, STATE OF CALIFORNIA

Sachi A. Hamai, Executive Officer-
Clerk of the Board of Supervisors
383 Kenneth Hahn Hall of Administration
Los Angeles, California 90012

At its meeting held Wednesday, November 5, 2008, the Board took the following action:

70-A

The following statement was entered into the record for Supervisor Antonovich:

"In 2005 the Antelope Valley East Kern Water Agency's ('AVEK') staff recommended to its Board of Directors to switch the disinfection of treated water at its treatment plants from chlorine to chloramines. This action was a result of a new drinking water standard imposed by the United States Environmental Protection Agency and the State of California. Given the new standard, chlorine is no longer a viable method of disinfection.

"The use of chloramines for disinfection of water has been in use throughout the United States. While utilized by other water agencies in California, chloramine treatment has never been used in the Antelope Valley. For example, the Littlerock Irrigation District, Palmdale Water District, Quartz Hill Water Company, and the Rosamond Community Standards District have always utilized alternatives to chloramines.

"In its deliberations, AVEK consulted with its larger customers, which includes the Los Angeles County Waterworks District 40. Although County staff supported the decision to convert to chloramine disinfection, staff did not notify customers in advance, nor did the District conduct any public outreach.

"Many residents in Antelope Valley have expressed concerns about chloramine treatment. These include concerns about potential allergic reactions, harmful affects to pets, degradation of infrastructure, and impacts upon residential septic systems. These issues should be considered before chloramine treatment is implemented. Waterworks District 40 staff should hold community meetings throughout the Antelope Valley to solicit input, answer questions, and address the public's concerns about chloramine disinfection."

(Continued on Page 2)

70-A (Continued)

Therefore, on motion of Supervisor Antonovich, seconded by Supervisor Molina, unanimously carried (Supervisor Yaroslavsky being absent), the Acting Director of Public Works was directed to take the following actions:

1. Immediately postpone the implementation of chloramine treatment by County Waterworks District 40 for a minimum of 120 days;
2. Coordinate with Antelope Valley East Kern Water Agency's staff on this action;
3. Conduct a public outreach effort that includes hosting community meetings throughout the Antelope Valley, providing information about chloramines to the media, and enclosing information about chloramines in water service bills to District customers; and
4. Report back to the Board within 120 days with a recommendation.

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Copies distributed:

Each Supervisor
Chief Executive Officer
County Counsel
Acting Director of Public Works

TECHNICAL MEMORANDUM



MWH

To: Russell Fuller
From: Jim Borchardt
Subject: GAC Alternatives for AVEK

Date: June 10, 2009
File:

Granular Activated Carbon (GAC) has been discussed as an alternate treatment process to monochloramines for control of disinfection by-products (DBP) at the Antelope Valley-East Kern Water Agency (AVEK) surface water treatment plants. AVEK has planned and built facilities to utilize monochloramine to control formation of DBPs such as total trihalomethanes (TTHMs) and haloacetic acids (HAA5). However, concerns expressed by some customers regarding the use of monochloramines have resulted in the request to more fully document the GAC alternative.

This memorandum presents the MWH investigation on the use of GAC for the control of DBPs, including the development of conceptual cost estimates for incorporating this process into the AVEK treatment facilities.

Background

AVEK is nearing completion of the DBP Control Project to upgrade their treatment plants with ozonation, deep-bed, biologically active carbon filters, standby primary disinfection, and monochloramines. These new facilities will provide substantial water quality improvements, including cryptosporidium inactivation and taste and odor control. Chemical feed facilities to create a disinfectant residual using monochloramine have been completed, but have not been placed into service pending a final decision on this treatment approach.

Implementation of monochloramines will require coordination with the California Department of Public Health, public notification, chemical purchase contract, and a monitoring program. It is estimated that implementation would incur additional operational costs of approximately \$5 to \$8 per acre-foot and require about 9 months to complete.

GAC Alternative Development

Alternatively, GAC facilities could be added to each of AVEK's four existing treatment facilities. The GAC facilities would work effectively with AVEK's other treatment processes, and would be installed following the existing filters and before the addition of chlorine. Chemical feed facilities for monochloramines would simply remain inactive, and free chlorine would be used for the disinfectant residual.

Treatment using GAC for DBP control would require extensive new facilities, including GAC contactors (vessels), civil site work to allow access for truck loading/unloading, washing and washwater recovery facilities, and new pump stations to allow treated water to be returned to

the plant clearwells. Sufficient space must be provided at each site, along with connections to main roadways, major piping, electrical switchgear, and instrumentation and control systems. At a conceptual level, it appears that implementation is feasible at each treatment plant, and will require CEQA compliance, financing, design and construction of facilities, coordination with the California Department of Public Health, GAC purchase contract, and a monitoring program. It is estimated that the GAC alternative would require between 36 and 42 months for completion.

Predicted GAC Requirements

Integrating post-filtration GAC into the existing treatment processes would reduce the subsequent formation of TTHMs and HAA5 in the distribution system by removing a fraction of organic precursor compounds from the water. Two reports on GAC treatment of State Water Project (East Branch) were reviewed to evaluate the technical and economic aspects of this approach on AVEK facilities:

- Booth, S. et al. (2006) DBP control in high bromide water while using free chlorine during distribution, AwwaRF report.
- MWH Report (2001) Crestline-Lake Arrowhead Water Agency Disinfection Alternatives Evaluation.

In each instance, field data show GAC contactors operated with 15 to 20 minute empty bed contact times (EBCT) on average water quality provide effective removal of DBP precursors for a period of about 60 to 75 days before breakthrough requires GAC replacement. GAC replacement frequency may be increased if multiple contactors are operated in parallel and in a staggered configuration. This is a common mode of operation in which one contactor is taken off-line at a time when the blended effluent exceeds the target effluent TTHM concentrations. Analysis shows that if ten or more contactors are utilized in this fashion, the GAC replacement frequency can be extended.

The capacity and average water production of the AVEK treatment plants are shown in **Table 1**. In total, AVEK's treatment plants provide 118 mgd of capacity and produce on average about 88,000 ac-ft of treated water.

Table 1 – AVEK Water Production Data

Plant	Design Capacity (MGD)	Average Production (MGD)	Average Production (ac-ft/yr)
Acton	4	2.7	3,025
Eastside	10	6.7	7,500
Rosamond	14	9.3	10,400
Quartz Hill	90	60	67,200

One important consideration for predicting GAC performance requirements is the presence of high levels of bromide in the raw water. Replacement becomes more frequent when bromide levels increase. Unfortunately, this does periodically occur in State Water Project supplies due to the influence of the Sacramento-San Joaquin River Delta on water quality.

For this reason, both average and high bromide conditions are presented in the analysis. Based on the two studies referenced above, the predicted GAC requirements for each of AVEK's four treatment plants are presented below in **Table 2**. In total, AVEK would need to purchase nearly 11 million pounds of GAC in an average year to comply with the DBP regulations at all four plants. In a year of poor water quality, GAC purchases could increase to as much as 19 million pounds.

Table 2 – GAC Contactor and Replacement Requirements

Plant	No. Vessels	Replacement Period		GAC Inventory (lbs)	GAC Use (lbs/yr)	
		Ave Br	Hi Br		Ave Br	Hi Br
Acton	8	130	70	160,000	450,000	830,000
Eastside	20	160	90	400,000	920,000	1,600,000
Rosamond	28	160	90	560,000	1,300,000	2,300,000
Quartz Hill	180	160	90	3,600,000	8,200,000	14,600,000

¹ Empty Bed Contact Time (EBCT) is 15 minutes

² GAC contactor vessels hold 20,000 lbs.

³ GAC utilization rate is 0.045 g/l, Booth S., et al (2006)

Estimated GAC Costs

Construction and O&M costs have been estimated for each of AVEK's four treatment plants based on the requirements presented above. Estimates are in June 2009 dollars and do not account for inflation. The opinion of probable construction cost reflects a conceptual level of project development (AACE Class 5), with a range of accuracy from -30 to +30%. Engineering, administration, and construction contingency are included at the stated percentage.

Quotes were received both for costs of GAC contactor vessels and GAC purchase, and the lowest quotes were used in each instance. For the purposes of this conceptual study, GAC vessels have been assumed at all four installations. While this is a likely configuration for the three smaller plants, additional engineering effort might find custom concrete GAC contactors more appropriate at the larger Quartz Hill Plant. This level of refinement should be considered if future studies are warranted.

The results of the costs estimates are presented in Tables 3 and Table 4 on the following page.

Table 3 – Opinion of Probable Construction Costs¹

Cost Items	Acton	Eastside	Rosamond	Quartz Hill
Contactor Vessels ²	\$ 880,000	\$ 2,200,000	\$ 3,100,000	\$ 19,800,000
Pump Station	200,000	300,000	500,000	1,300,000
Civil/Sitework	300,000	600,000	700,000	4,700,000
Yard Piping	200,000	500,000	600,000	4,900,000
Electrical/I&C	300,000	700,000	800,000	3,900,000
Sub-Total	\$ 1,900,000	\$ 4,300,000	\$ 5,700,000	\$ 34,600,000
Engineering/Admin (20%)	400,000	800,000	1,100,000	6,900,000
Contingency (30%)	600,000	1,300,000	1,700,000	10,400,000
Total Estimated Cost	\$ 2,900,000	\$ 6,400,000	\$ 8,500,000	\$ 52,000,000

¹ The Class 5 opinion of probable construction cost is prepared in accordance with the Association for the Advancement of Cost Engineering. It is acknowledged that MWH has no control over costs of labor, materials, competitive bidding environments and procedures, unidentified field conditions, financial and/or market conditions, or other factors likely to affect the opinion of probable construction cost of this project, all of which are and will unavoidably remain in a state of change, especially in light of the high volatility of the market attributable to Acts of God and other market events beyond the control of the parties. It is further acknowledged that this is a "snapshot in time" and that the reliability of this opinion of probable construction cost will inherently degrade over time. MWH cannot, and does not, make any warranty, promise, guarantee, or representation, either expressed or implied, that proposals, bids, project construction costs, or cost of operation or maintenance will not vary substantially from MWH's good faith Class 5 opinion of probable construction cost.

² GAC contactor vessel cost based on quote provided by Calgon Carbon Corporation

Table 4 – Estimated O&M Costs

Cost Items	Acton	Eastside	Rosamond	Quartz Hill
GAC Replacement ¹	\$ 680,000	\$ 1,380,000	\$ 1,950,000	\$ 12,300,000
Labor ²	52,000	52,000	52,000	104,000
Energy ³	9,000	24,000	32,000	210,000
Maintenance ⁴	58,000	130,000	170,000	1,040,000
Total Annual O&M Cost	\$ 800,000	\$ 1,600,000	\$ 2,200,000	\$ 13,600,000

¹ GAC replacement cost estimated at \$1.50 per pound.

² Labor estimated at \$50 per hour.

³ Energy estimated at \$0.15 per kwh and 21 kwh per ac-ft/yr.

⁴ Maintenance estimated at 2% of estimated construction cost.

The values from Tables 3 and 4 are summarized and presented below in Table 5 as annual and unit costs. Unit costs of GAC treatment for DBP control at the AVEK plants are estimated to range from a low of \$265 per acre-foot to a high of \$340 per acre-foot, with an average across of all four plants of \$270 per acre-foot.

Table 5 – Estimated Annual and Unit GAC Costs

Plant	Construction Cost (\$)¹	O&M Cost (\$)	Total Annual Cost (\$)	Unit Cost (\$/ac-ft)
Acton	\$ 230,000	\$ 800,000	\$ 1,030,000	\$ 340/ac-ft
Eastside	510,000	1,600,000	2,100,000	\$ 280/ac-ft
Rosamond	680,000	2,200,000	2,900,000	\$ 280/ac-ft
Quartz Hill	4,200,000	13,600,000	17,800,000	\$ 265/ac-ft
Totals	\$ 5,600,000	\$ 18,200,000	\$ 23,800,000	\$ 270/ac-ft

¹ Based on 5% interest rate and 20 year recovery period (Capital Recovery Factor = 0.08024).

Additional Considerations

GAC replacement accounts for roughly 90% of the annual O&M cost and 70% of the combined total annual cost. Probable costs are highly dependent upon the assumed carbon utilization rate, which may vary depending on raw water quality, performance of other treatment processes, the presence of bromide, and the specific characteristics of the GAC. One example of this has been illustrated in Table 2, where high bromide alone could increase GAC use by 80% over average conditions.

The GAC alternative would limit TTHM concentrations in the distribution system to a range of about 60 to 80 ug/l, while the monochloramine alternative would control TTHM concentrations to below 30 ug/l. To lower TTHM concentrations to equal levels, the costs of GAC treatment would increase substantially to nearly \$700 per acre-foot, in comparison to the \$5 to \$8 per acre-foot for monochloramines.

Other considerations associated with a GAC alternative include:

- GAC costs are variable and closely tied to the price of energy for manufacture and transport.
- Roughly 90% of GAC is currently imported and supply reliability is not assured.
- The future of import tariffs on GAC costs is not known.
- Implementation of the GAC alternative would make AVEK the largest known public user of GAC west of the Mississippi River.
- It is estimated that use of GAC at AVEK will consume roughly 120,000 mwh of power and generate about 100,000 metric tons of carbon dioxide each year.